CLAIMS

Therefore, having thus described the disclosure, at least the following is claimed:

1. An apparatus for detecting a selected material that changes an effective dielectric constant of a circular resonator, the apparatus comprising:

an input waveguide being capable of receiving electromagnetic wave;

an output waveguide; and

a circular resonator located adjacent to the input and output such that the electromagnetic wave is coupled in and out of the circular resonator, the resonator being capable of bonding to the selected material such that the selected material changes the power of the electromagnetic wave in the circular resonator, wherein the output waveguide receives the change in the power of the electromagnetic wave in the circular resonator.

2. The apparatus as defined in claim 1, wherein the circular resonator causes the electromagnetic wave to travel many times within the circular resonator during a build-up stage, the electromagnetic wave being interactive with the selected material many times causing the change in the power of the electromagnetic wave in the circular resonator.

3. The apparatus as defined in claim 1, wherein the electromagnetic wave stabilizes at resonance condition in the circular resonator and the selected material bonded to the circular resonator causes the power of the electromagnetic wave at resonance condition in the circular resonator to change.

4. The apparatus as defined in claim 1, wherein the input and output waveguides are substantially straight.

5. The apparatus as defined in claim 1, wherein the circular resonator is shaped as one of a ring and racetrack waveguide.

6. The apparatus as defined in claim 1, wherein the selected material is one of a chemical substance and bio-agent.

7. The apparatus as defined in claim 1, wherein the circular resonator further comprises a cladding layer, wherein the selected material is capable of changing the dielectric constant of the cladding layer.

8. The apparatus as defined in claim 1, wherein the input and output waveguides are substantially parallel to each other and the circular resonator is located between the waveguides.

9. The apparatus as defined in claim 1, wherein the resonator being capable of bonding to the selected material is in direct contact or in close proximity with the selected material.

10. The apparatus as defined in claim 1, further comprising another circular resonator located adjacent to the circular resonator and between the waveguides forming a cascade arrangement.

11. The apparatus as defined in claim 1, further comprising a fluidic channel that the selected material can pass through and interact with the circular resonator.

12. The apparatus as defined in claim 1, further comprising:

another circular resonator;

another input waveguide; and

another output waveguide, wherein the input waveguides are arranged substantially in parallel to each other, the output waveguides are arranged substantially in parallel to each other and substantially perpendicular to the parallel input waveguides, the circular resonators being located in the center of the input and output waveguides forming an array arrangement.

13. A method for detecting a selected material that changes an effective dielectric constant of a circular resonator, the method comprising the steps of:

inputting an electromagnetic wave into an input waveguide;

coupling the electromagnetic wave received by the input waveguide to a circular resonator;

bonding the selected material to the circular resonator such that the selected material changes the power of the electromagnetic wave in the circular resonator; and

receiving electromagnetic wave in the circular resonator that was changed by the bonding of the selected material to the circular resonator.

14. The method as defined in claim 13, further comprising causing the electromagnetic wave to travel many times within the circular resonator during a build-up stage, wherein the electromagnetic wave interacts with the selected material many times causing the change in the power of the electromagnetic wave in the circular resonator.

15. The method as defined in claim 13, further comprising stabilizing the electromagnetic wave at resonance condition in the circular resonator, wherein the selected material bonded to the circular resonator causes the power of the electromagnetic wave at resonance condition in the circular resonator to change.

16. The method as defined in claim 13, further comprising bonding the selected material to a cladding layer of the circular resonator, wherein the selected material is capable of changing the dielectric constant of the cladding layer.

17. The method as defined in claim 13, wherein attaching the selected material to the circular resonator further comprises the selected material being in direct contact or in close proximity with the circular resonator.

18. The method as defined in claim 13, further comprising providing another resonator forming a cascade arrangement.

19. The method as defined in claim 13, further comprising providing another resonator, another input waveguide and another output waveguide forming an array arrangement.

20. The method as defined in claim 13, wherein the input and output waveguides are substantially straight.

21. The method as defined in claim 13, wherein the circular resonator is one of a ring or racetrack resonator.

22. The method as defined in claim 13, further comprising providing a fluidic channel located on top of the circular resonator.

23. The method as defined in claim 13, further comprising providing a cladding layer to the circular resonator.

24. The method as defined in claim 13, further comprising placing the input and output waveguides substantially in parallel to each other and placing the circular resonator between the waveguides.

25. A method for detecting the presence of a chemical or bio-agent, the method comprising the steps of:

inputting an electromagnetic wave into an input waveguide;

coupling the electromagnetic wave received by the input waveguide to a circular resonator;

bonding the chemical or bio-agent to the circular resonator such that the chemical or bio-agent changes the power of the electromagnetic wave in the circular resonator; and

receiving electromagnetic wave in the circular resonator that was changed by the bonding of the chemical or bio-agent to the circular resonator.

26. The method as defined in claim 25, further comprising causing the electromagnetic wave to travel many times within the circular resonator during a build-up stage, wherein the electromagnetic wave interacts with the selected material many times causing the change in the power of the electromagnetic wave in the circular resonator.

27. The method as defined in claim 25, further comprising stabilizing the electromagnetic wave at resonance condition in the circular resonator, wherein the selected material bonded to the circular resonator causes the power of the electromagnetic wave at resonance condition in the circular resonator to change.

28. The method as defined in claim 25, further comprising bonding the chemical or bio-agent to a cladding layer of the circular resonator, wherein the chemical or bio-agent is capable of changing the dielectric constant of the cladding layer.

29. The method as defined in claim 25, wherein bonding the chemical or bio-agent to the circular resonator further comprises the chemical or bio-agent being in direct contact or in close proximity with the circular resonator.

30. The method as defined in claim 25, further comprising providing another resonator forming a cascade arrangement.

31. The method as defined in claim 25, further comprising providing another resonator, another input waveguide and another output waveguide forming an array arrangement.

32. The method as defined in claim 25, wherein the input and output waveguides are substantially straight.

33. The method as defined in claim 25, wherein the circular resonator is one of a ring or racetrack resonator.

34. The method as defined in claim 25, further comprising providing a fluidic channel located on top of the circular resonator.

35. The method as defined in claim 25, further comprising providing a cladding layer to the circular resonator.

36. The method as defined in claim 25, further comprising placing the input and output waveguides substantially in parallel to each other and placing the circular resonator between the waveguides.